

## NESTING POPULATIONS OF RED-TAILED HAWKS AND HORNED OWLS IN CENTRAL NEW YORK STATE<sup>1</sup>

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FROM the fall of 1948 through the spring of 1952 the writer made observations on raptor populations of southeastern Madison County in New York State. The original intention was to locate the nests and band the young. Efforts were confined therefore to the late winter and spring months, although observations also were made in fall and early winter. The field notes for the four-year period form the basis of this paper. Jack T. Moyer assisted in field work during the first two seasons, while we became acquainted with the country and learned the habits of the birds. However, the data obtained during 1951 and 1952 were more extensive.

Early in the study it was found that the Red-tailed Hawk (*Buteo jamaicensis*) and Horned Owl (*Bubo virginianus*) were the dominant large raptors of the area, occurring much more commonly than other large species, such as the Red-shouldered Hawk (*Buteo lineatus*), Broad-winged Hawk (*Buteo platypterus*), Barred Owl (*Strix varia*) and Cooper's Hawk (*Accipiter cooperii*). Accordingly, our attention was directed largely to the first two species. Data for the Red-tailed Hawk are based on 38 nest sites, 24 pairs with active nests, and 21 broods. The estimated density of their population in the spring of 1952 on the designated study area was 26 pairs (Fig. 1). For the owl there were 14 nest sites, 18 nesting pairs, 16 broods, and their population was estimated to be about 11 pairs in the spring of 1952 (Table 1).

Observations and banding returns indicated that the Red-tailed Hawks were migratory. None was observed after December 5 or before February 10 during the four-year period. Seven hawks banded as young were recovered in winter, all far to the southwest of central New York. This study substantiated those of other workers that the Horned Owl is non-migratory in this part of its range (Bent, 1938). Two of 21 owls banded as nestlings were recovered within a year of their fledging, 20 and 5½ miles from their respective nest sites. In general, Horned Owls seemed more numerous in winter than at other times of year.

Prey or prey-remains found in many nests indicated that during the nesting season the owls killed many cottontail rabbits (*Sylvilagus floridanus*), whereas the hawks fed extensively on young woodchucks (*Marmota monax*). However, a great variety of prey species was found in the nests of both raptors.

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## DESCRIPTION OF THE AREA

The search for nests extended over an area 52 square miles in extent (Fig. 1), comprising most of the town of Hamilton and portions of the towns of Madison, Eaton and Lebanon. This part of New York is on the northern edge of the Appalachian Plateau. Drainage is to the south via numerous small streams and rivers which are a part of the Susquehanna system. The ridges, arranged in long, parallel north-south chains, average 1,500 to 1,600 feet in elevation, and rise 300 to 500 feet above the main valley floors.

Land in the area is nearly equally divided between woodland and farmland. The latter is largely in crops in the main valleys though there are a

TABLE 1  
PAIRS WITH EGGS AND YOUNG UNDER OBSERVATION, 1949-1952

Season	Red-tailed Hawk	Horned Owl
1949	2	2
1950	4	2
1951	7	6
1952	11	8
TOTALS	24	18

few rather extensive wooded swamps there also. Agricultural land on the uplands is in pasture, well interspersed with woodlots. Ineffective fencing sometimes allows cattle free access to the latter. The preferred habitat for nesting raptors seemed to be in or along the borders of the mature upland woodlots.

Sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), and white ash (*Fraxinus americana*) in that order of importance are the dominant trees of the mature upland forests. A few large hemlocks (*Tsuga canadensis*), often scattered among these hardwoods, are of importance as roost trees, especially for Horned Owls. Occasionally there are pure stands of mature hemlock but they usually occur in ravines and never cover extensive areas. Other less important although common trees include basswood (*Tilia americana*), black cherry (*Prunus serotina*), yellow birch (*Betula lutea*), and elm (*Ulmus americana*).

Wooded swamps in the lowland are largely of dense stands of arborvitae (*Thuja occidentalis*), white pine (*Pinus strobus*), and hemlock. Horned Owls were often heard or observed in this association, whereas it seemed that Red-tailed Hawks favored the uplands exclusively.

## METHODS

The nesting sites of raptors were located by searching through woodlots for bulky nests during the late fall, winter, or early spring when the trees

were leafless. The locations of these nests were plotted on Army Map Service maps (scale 1:25,000) which, incidentally, show all of the wooded areas conveniently outlined in green. When these nests were revisited during the breeding season they often were occupied. When not, a short search in the immediate vicinity, usually the same woodlot, frequently revealed a new nest. Some pairs of Horned Owls were located by listening for their calls during late February. The nests of a few pairs of Red-tailed Hawks were found after the birds had been observed courting over their nesting woods or by watching them come and go on their hunting forays or while carrying nest-building material.

TABLE 2  
OCCUPANCY OF EIGHT NESTS USED MORE THAN ONCE

Nest Number	Tree Species	1949	1950	1951	1952	Total years in use
1	Beech	Hawk			Hawk	2
2	Sugar maple			Hawk	Hawk	2
3	Beech			Hawk	Owl	2
4	Beech		Hawk		Owl	2
5	Beech			Owl	Owl	2
6	Beech	Owl	Owl			2
7	Beech		Hawk	Owl	Hawk	3
8	Beech	Owl	Owl		Owl	3

#### NEST SITES AND BREEDING SEASONS

*Horned Owl*.—The hooting of the Horned Owl was heard occasionally on still evenings and early mornings during the fall and winter, but it became most regular during late January and the first two or three weeks in February. Most birds apparently appropriated nests and began incubating eggs by the last week in February or the first week in March. One was incubating as early as February 15. The eggs hatched about the end of March and the nestlings usually were fledged before the end of April. One nest was occupied until the end of May, but it is believed that this is exceptional.

*Red-tailed Hawk*.—The hawks were observed building new nests or repairing old ones as early as February 19, but rarely laid eggs before the last week in March. Hatching probably occurred during the last week in April or the first week in May, although no detailed observations of nests were made until young were present. The nestlings generally left during the last few days of May and the first 10 days in June. This breeding schedule appeared to be similar to that obtaining in southeastern Massachusetts (Bent, 1937).

Both species of raptors exhibited a tendency to re-occupy the same territory, in some cases even the same nest, in consecutive years. Fourteen of 19 nests of the hawk under observation for more than one year were used in one season only, whereas five were occupied another season (or seasons) either by the hawks or by the owls. Seven of 13 owl nests were occupied for one season only, while six were occupied in more than one year by either species.

TABLE 3  
HISTORY OF OCCUPANCY OF THE ELEVEN WOODLOTS USED MORE THAN ONCE

Woodlot	Approx. acreage	1949	1950	1951	1952	Total years in use
1	60	? <sup>1</sup>	?	Hawk	Hawk	2
2	20	?	?	Hawk	Hawk	2
3	15	?	?	Hawk	Owl	2
4	90	?	?	Hawk	Hawk & Owl <sup>2</sup>	2
5	160	?	?	Owl	Hawk & Owl <sup>2</sup>	2
6	60	?	—	Owl	Owl	2
7	25	Hawk	Hawk	Hawk	—	3
8	70	—	Hawk	Hawk	Hawk	3
9	175	?	Hawk	Owl	Owl	3
10	120	Hawk & Owl	Hawk & Owl	Hawk	Owl	4
11	40	Owl	Owl	Owl	Hawk & Owl <sup>2</sup>	4

<sup>1</sup> Query indicates that woodlot was not searched thoroughly.

<sup>2</sup> Both pairs raised young.

A record of eight nests that were used more than once (Table 2) shows that reoccupancy of a previous year's nest by individuals of the same species occurred three times by the hawks and four times by the owls. The two alternated in their use of one nest and exchanged two others. The owls appeared to be quite dependent upon the hawks for providing them with nests. In five known cases owls appropriated nests built by hawks, and eight other nests used by owls were thought, because of their position and construction, to have been built by hawks originally. Owls usually appropriated hawk nests of a previous season but twice they occupied new hawk nests the same season that they were built. In southeastern Massachusetts 11 of 13 Horned Owl nests were old nests of the Red-tailed Hawk (Bent, 1938). Crows (*Corvus brachyrhynchos*), Gray Squirrels (*Sciurus carolinensis*), and Raccoons (*Procyon lotor*) also used old hawk nests.

The tendency toward use of the same woodlots in different years appeared

more general than that toward re-use of individual nests. Successive use of certain woodlots by both hawks and owls is shown in Table 3.

In general, this rather small sample indicates that both species use the same woodlot year after year and that owls tend to use a previous year's nest more than the hawks.

The owls seemed to prefer the larger woodlots, most of their nests being

TABLE 4  
CROWN VEGETATION IN THE VICINITY OF NEST SITES

Forest composition	NESTS	
	Horned Owl	Red-tailed Hawk
1. Mature, deciduous: beech and/or sugar maple predominating; scattered hemlock	10	10
2. Mature, deciduous: beech and/or sugar maple; no hemlock	2	18
3. Virtually pure stands of sub-mature sugar maple; no hemlock	1	5
4. Other		
a. Like no. 1 but scattered Norway spruce in place of hemlock	1	—
b. Lone trees in open pasture or recently cut-over land	—	5
Total Nests	14	38

in tracts of more than 20 acres. The smallest lot used was 15 acres. Red-tailed Hawks were less dependent on the large woodlots, 13 (about one-third) of their nests being in tracts of 20 acres or less. Three of these were in quite isolated trees standing in open pasture as far as 50 yards from the nearest woods. The largest woodlot used by both species was 175 acres in extent, the biggest on the study area.

Horned Owls showed their preference for dense woods in another way. Over half their nests were near the center of woodlots while fewer than 40 per cent of the hawk nests were in this position. The immediate vegetation about the nests of both species seemed to fall into three quite distinct categories (Table 4). Most pairs of both hawks and owls preferred the mature deciduous forest, and a scattering of hemlocks seemed quite necessary for the owls. Crown closure of trees about all the nest sites of the owl was nearly complete. For actual nest trees the hawk used four species: beech, 17 nests; sugar maple, 16 nests; American elm, three nests; and yellow birch, two nests. The owl occupied 10 nests in beech trees and one nest each in sugar maple, red oak (*Quercus borealis*), black cherry and an introduced Norway spruce (*Picea abies*).

## POPULATION DENSITY

In the spring of 1952 each woodlot on the study area that appeared to be reasonably suitable for habitation by raptors was searched. Nest site locations and other observations were plotted on maps to determine centers of greatest activity for every pair. The term "territory" is avoided in this discussion because there was little evidence that territorial boundaries were well defined. Results of the census indicated that the combined population of hawks and owls averaged one pair per 1.4 square miles.

*Horned Owl Density.*—Eleven pairs of Horned Owls were located on the study area in the spring of 1952. Occupied nests of eight of these pairs were found; each successfully raised young. Additional pairs could have been overlooked through failure to cover the lowland swamps. It is doubted that suitable lowland habitat was extensive enough to have supported more than four additional pairs. There was a suggestion that these areas were inhabited by single birds, as evidenced by the nature of their hooting. With a minimum population of 11 pairs the density for the study area (52 square miles) would have been about one pair per 4.4 square miles.

Baumgartner (1939), from studies of this species near Lawrence, Kansas, and Ithaca, New York, states that on optimum range, populations seem to average from one to three pairs per square mile but usually are much lighter. In the region about Ithaca, where cover and topography are similar to that about Hamilton, he believed that in 1934 and 1935 the birds did not average more than one pair to three or four square miles during the spring.

*Red-tailed Hawk Density.*—The population on the study area probably was about 26 pairs during the spring of 1952. Occupied nests at the beginning of the egg-laying period numbered 17, but only 10 of these pairs successfully raised young. Centers of activity for the other nine pairs were more obscure. In three instances a pair may have been counted twice. Since the hawks tended to avoid the lowlands, and since all upland areas were searched very thoroughly, it seems unlikely that any were overlooked. The minimum number of pairs was therefore estimated to be 23, and the resulting population density approximately one pair per 2.2 square miles.

In Madera County, California, Fitch *et al.* (1946) found the population density of Red-tailed Hawks was one pair to half a square mile (320 acres). Differences in habitat and food supply may have been responsible for this greater density.

## LOCAL DISTRIBUTION OF PAIRS

The map (Fig. 1) shows the distribution of pairs of both Horned Owls (circles) and Red-tailed Hawks (triangles) during the spring of 1952. Each symbol represents the center of activity of a single pair. Solid circles or triangles indicate occupied nests, and open circles or triangles, places where



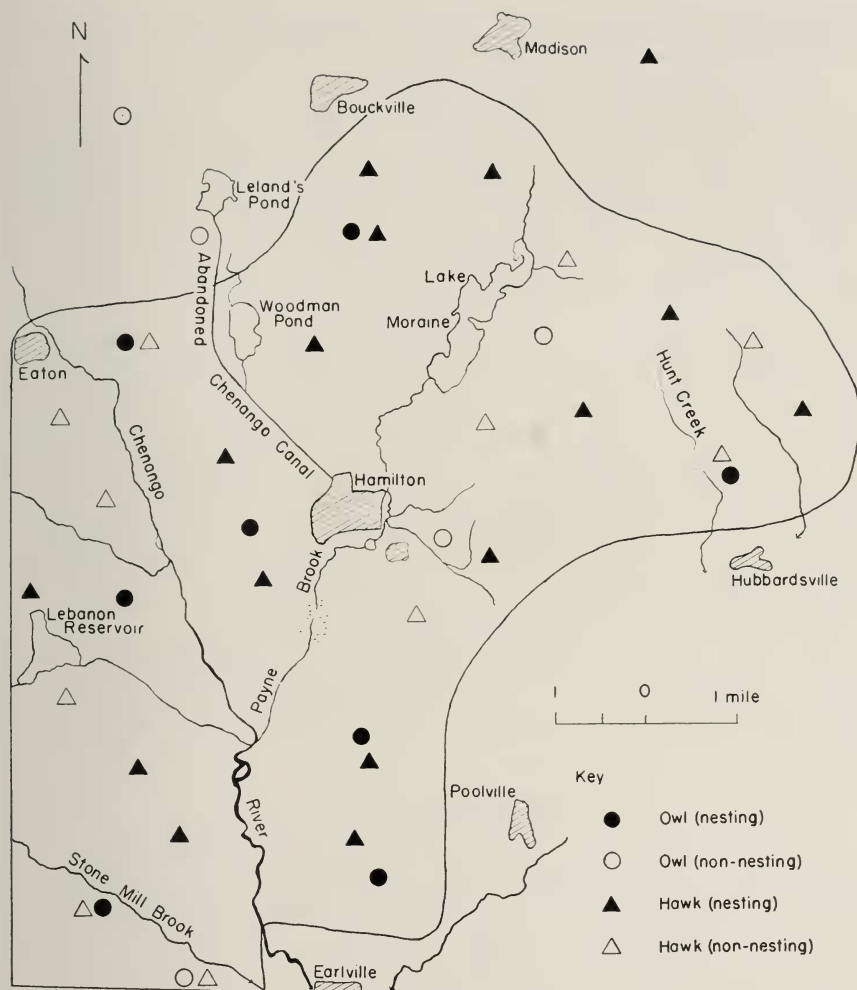


FIG. 1. Distribution of pairs of Horned Owls and Red-tailed Hawks in the spring of 1952.

pairs were observed, usually with unoccupied nests. There is a fairly even distribution of both species, with slightly greater concentration of owls in the western and southern portions where woodlots are more extensive.

Hawks and owls often nested, or attempted to nest, in the same woodlots, sometimes very near together (Table 3 and Fig. 1). This proximity and the fact that the owl often used old nests of the hawk suggest that the two raptors are quite tolerant of one another in their nesting and territorial habits. However, Bent (1939) considered them to be complementary species. Tolerance

is further indicated by the attempts of the two to occupy closely adjacent nest sites over the four-year period.

In 19 attempts to use a nest site separated from that of another raptor by not more than half a mile, there were 11 failures, four successes and four instances where the outcome was uncertain. The hawk was driven off in nine of the 11 failures and the owl was loser only twice. Two of the successful nestings were accomplished only after one pair, probably in both instances the hawks, moved to a greater distance. The other two successful close nestings, where the distances were only 700 and 350 yards, respectively, evidently represent maximum interspecific tolerance.

Intraspecific tolerance, as indicated by distances between nesting pairs, was somewhat less. Adjacent nests of Red-tails generally were separated by more than a mile, although two pairs successfully raised young only 0.7 miles apart. The minimum distance between two nesting pairs of owls was 1.25 miles. Distances between each nest or center of activity and next nearest for hawks and owls averaged 1.1 and 1.8 miles, respectively.

Other investigations have indicated that the Horned Owl has a smaller home range than my data indicate. Baumgartner (1939) substantiated the findings of Miller (1930), who showed that the feeding range seldom exceeded a quarter of a mile in any direction from the nest.

Fitch *et al.* (1946) found that the boundaries of Red-tailed Hawk territories were usually ill-defined; with a population apparently near saturation the birds centered their activities about an area of no more than half a square mile.

#### REPRODUCTION RATE

Of 18 active nests of the owl located during the four-year period, two were deserted. The number fledged in the 16 occupied nests ranged from one to three and averaged 1.7. There was no known infertility of eggs or mortality of young. Of 37 nests of the hawk, 15 apparently were deserted. The range of brood size was the same as for the owl and the average number of young per brood was 1.9. One young hawk apparently succumbed while in a weakened condition during a cold rain. It was subsequently eaten by the surviving nest mate. Two other instances of juvenal mortality were attributed to human disturbance. No infertile eggs were found.

There was a noticeable decline in number of young produced per pair in 1952 from that of 1951 for both species (Table 5). The lower reproductive rate in 1952 resulted from smaller average brood size rather than in the percentage of deserted nests. Average brood size for the Horned Owls was 2.2 in 1951 and 1.5 in 1952; for Red-tailed Hawks the averages were 2.7 and 1.4 young, respectively. Broods of hawks in 1952 may have suffered from heavy rains in May. Weather conditions may have influenced survival within owl



broods but no accurate correlations were made. No attempt was made to gauge prey abundance or other possible determining factors.

NEST DESERTION

Horned Owls showed little tendency to desert, whereas the Red-tailed Hawks abandoned 40 per cent of their nests each season. The hawks that apparently deserted usually did so early in the season, often, I suspected, before eggs were even laid. They would build firm nests of sticks but further breeding activity was decidedly casual. These may have been pairs in which one or both birds were too young to perform the full breeding cycle.

TABLE 5  
NESTING SUCCESS IN 1951 AND 1952

Horned Owl			Red-tailed Hawk		
Nests active at beginning of season	Young in nest	Average young per occupied nest	Nests active at beginning of season	Young in nest	Average young per occupied nest
1951					
1	3		4	3	
4	2		1	2	
1	deserted		1	?	
<u>6</u>	<u>11</u>	2.2	<u>4</u>	<u>deserted</u>	
			10	14+	3
1952					
1	3		5	2	
2	2		5	1	
5	1		1	?	
<u>8</u>	<u>12</u>	1.5	<u>7</u>	<u>deserted</u>	
			18	15+	1.5

SUMMARY

Observations on hawks and owls were made on a 52-square-mile area in southeastern Madison County, New York, from the fall of 1948 through the spring of 1952, with the exception of summers.

The common, large raptors were Red-tailed Hawks and Horned Owls, and my attention was given to them, nearly to the exclusion of other species.

Both species showed a strong tendency to use their respective woodlots in successive years. The owls appeared to be dependent upon the hawks for providing nests. The owls seemed restricted to larger woodlots with scattered hemlock to a greater extent than were the hawks. Beech was the pre-

ferred nest tree of the owls, whereas beech and sugar maple were equally important for the hawks.

An estimated 11 pairs of Horned Owls and 23 pairs of Red-tailed Hawks on the area in the spring of 1952 gave breeding population densities of one pair per 4.4 square miles and one pair per 2.2 square miles, respectively. The combined population would have allowed 1.4 square miles per pair.

Individual pairs of hawks and owls often occupied overlapping territories but attempts to use closely adjacent nest sites usually resulted in abandonment by the hawks.

The hawks fledged 1.9 young per pair, and the owls, 1.7, on an average. The average brood sizes in 1952 were about half those in 1951 for both species.

Nearly 40 per cent of the freshly constructed Red-tailed Hawk nests found in early spring had no young, probably because eggs were never laid in them.

#### LITERATURE CITED

BAUMGARTNER, F. M.

1939 Territory and population in the great horned owl. *Auk*, 56:274-282.

BENT, A. C.

1937 Life histories of North American birds of prey. Pt. 1. *U.S. Nat. Mus. Bull.* no. 167.

1938 Life histories of North American birds of prey. Pt. 2. *U.S. Nat. Mus. Bull.* no. 170.

FITCH, H. S., F. SWENSON, AND D. F. TILLOTSON

1946 Behavior and food habits of the red-tailed hawk. *Condor*, 48:205-237.

MILLER, L.

1930 The territorial concept in the horned owl. *Condor*, 32:290-291.

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